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OCS Report
MMS 85-0108

Offshore Environmental
Studies Program

North Carolina Physical Oceanography Programs

U.S. Department of the Interior
Minerals Management Service
Atlantic OCS Region

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By James S. Lane

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Atlantic OCS Region

Vienna, Virginia
1986

Preface

This is a brief summary of past and on-going field physical oceanography studies funded by the Atlantic OCS Region in the vicinity of North Carolina. Completed studies are described by study title, measurement summary, and study cost. Active studies are described by study title, objectives, measurement type or period, reports or data, study cost, and visual of the study area. The information was presented on June 3, 1985, in Raleigh, N.C. at a meeting of a technical panel formed under the Memorandum of Understanding between the Department of the Interior and the State of North Carolina.

OFFSHORE ENVIRONMENTAL STUDIES PROGRAM
NORTH CAROLINA PHYSICAL OCEANOGRAPHY PROGRAMS

Title	Measurement Summary	Cost
So. Atlantic OCS Data Buoys	Three meteorological monitoring buoys were operated from 1976-1981 in the South Atlantic Bight. The closest one to North Carolina was off Charleston, S.C. at 32°31'N, 78°40'W. The following parameters were measured: a. wind direction and magnitude (5-m level), b. air temperature (5-m level), c. atmospheric pressure (surface), d. sea surface temperature (1-m depth), and e. surface wave spectral coefficients	$ 452,600
So. Atlantic OCS Satellite Oceanography	GEOS-3 statellite derived radar altimetry data was collected from August 29, 1978 - September 24, 1980. Methodology was developed to interpret the data to estimate geostrophic ocean current position and velocity, significant wave height, and surface wind speed.	$ 150,000
So. Atlantic Physical Oceanography (SAPOS)	Between 1977 and 1984, a field measurement and data interpretation and synthesis program was conducted for an area extending alongshore from approximately Cape Hatteras to Cape Canaveral and offshore across the shelf and the Blake Plateau. Emphasis was on shelf and shelfbreak processes. Primary measurements made in one or more program years include subsurface currents and temperature, satellite thermal imagery, coastal water levels, and coastal and marine winds. Program results describe Gulf Stream impacts on regional or process-specific circulation patterns; e.g., Gulf Stream meanders and boundary eddies or filaments. Also described is the response of shelf currents and water level to tidal and wind-stress-forcing mechanisms. Satellite imagery was used to support process studies as well as to provide a statistical description of the Gulf Stream western boundary. Hydrographic cruises resolved seasonal water mass characteristics on the shelf and Blake Plateau. Special studies were made of coastal fronts and shelf surface currents.	$4,589,414
Blake Plateau Current Study (Year 2)	Near bottom current and temperature measurements were made from May 1981 to June 1982 at 5 locations from the shelf break to approximately 3,000-m water depth along 36°N. On each of the 5 moorings, instruments were positioned about 100 m off the bottom.	$ 383,851
	Total Cost	$5,584,865

Final reports and data summaries are available for all of the completed studies.

In addition to field measurement programs, another $398,471 has been spent on environmental literature summaries and data syntheses for many areas of the Atlantic Continental Shelf and Slope. Data have been collected from published and unpublished sources and discussed in an integrated summary. Much of these data have been formatted and submitted to the National Oceanographic Data Center (NODC) on tape.

Active Field Measurement Programs

° Mid-Atlantic Slope and Rise Study (MASARS)

Objectives:

a. Determine broad-scale, general circulation features on the continental slope and rise on a seasonal basis.

b. Describe and quantify the variability in these areas in the vertical and horizontal plane.

c. Determine the degree to which the slope/rise circulation features influence the physical oceanography of the Middle Atlantic Continental Shelf.

d. Determine local currents and sediment distribution around the Block 372 deep-water drillsite.

Measurement Type or Period:

The field program comprises several data collection efforts spanning 25 months (February 1984 to March 1986):

a. Current measurements using two subsurface mooring arrays placed orthogonally to the local isobaths (Figure 1).

b. Hydrographic cruises along both mooring arrays. These cruises have presently been extended to allow sampling along an isobath running between the arrays. Sampling is performed every three months (Figure 2).

c. Collection of data from other programs in the Mid-Atlantic area which is being shared with MASARS (Figure 3).

The first of two arrays is situated towards the northern end of the study area and consists of a series of 5 cross-isobath moorings from 38°43'N and the 200-m isobath to 38°10'N and the 3000-m isobath. The southern array consists of 3 moorings beginning at 36°52'N in 1000-m depth and ending on the 3000-m isobath at 36°34'N.

Reports or Data:

Approximately half of the field data collection has been completed. Two semiannual progress reports and cruise reports are available. There are interim data products available as well. The final report is due in September 1986.

Cost:

$2,140,693

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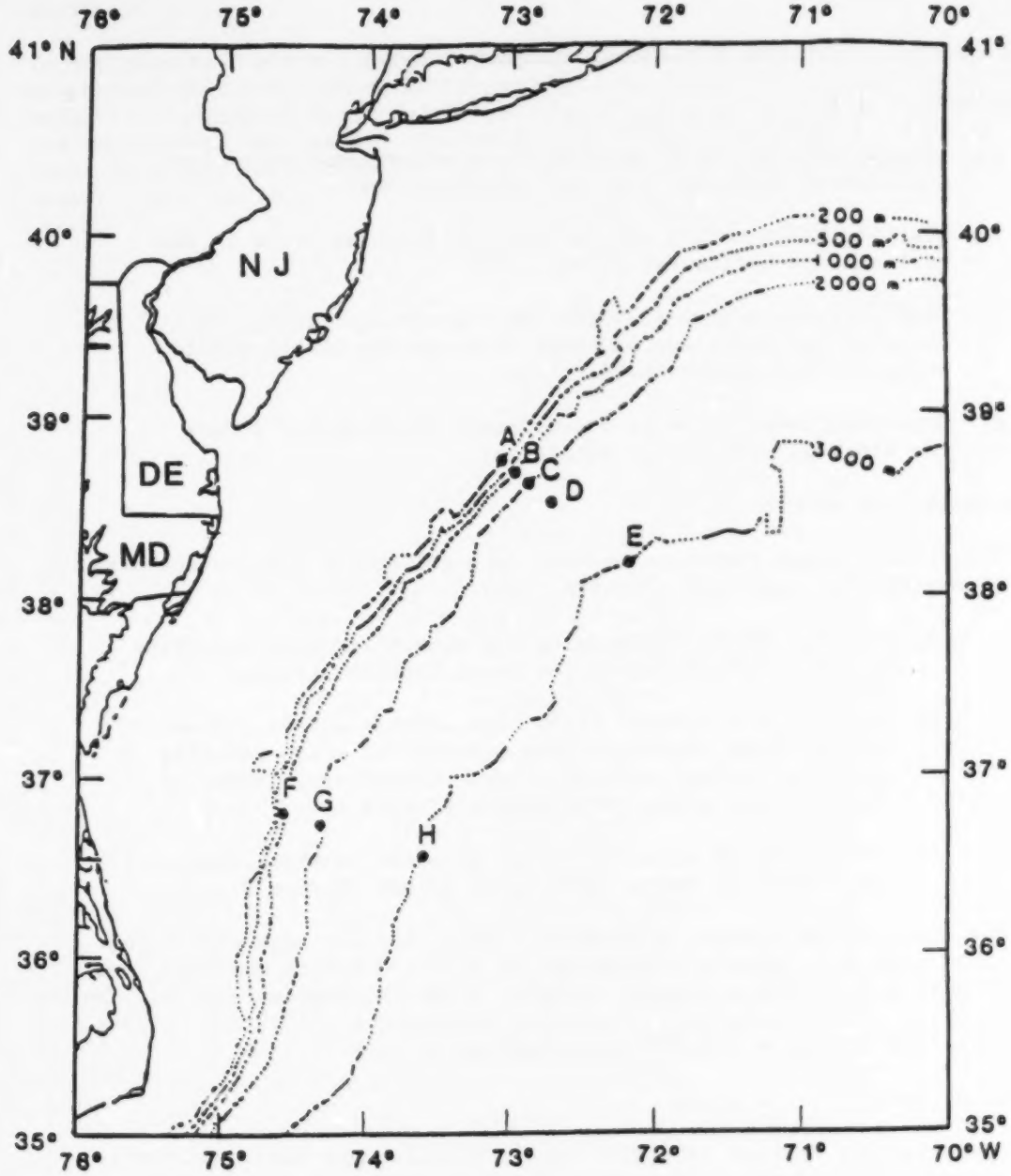

Figure 1. MASAR current-meter mooring locations from February 1984 to March 1986.

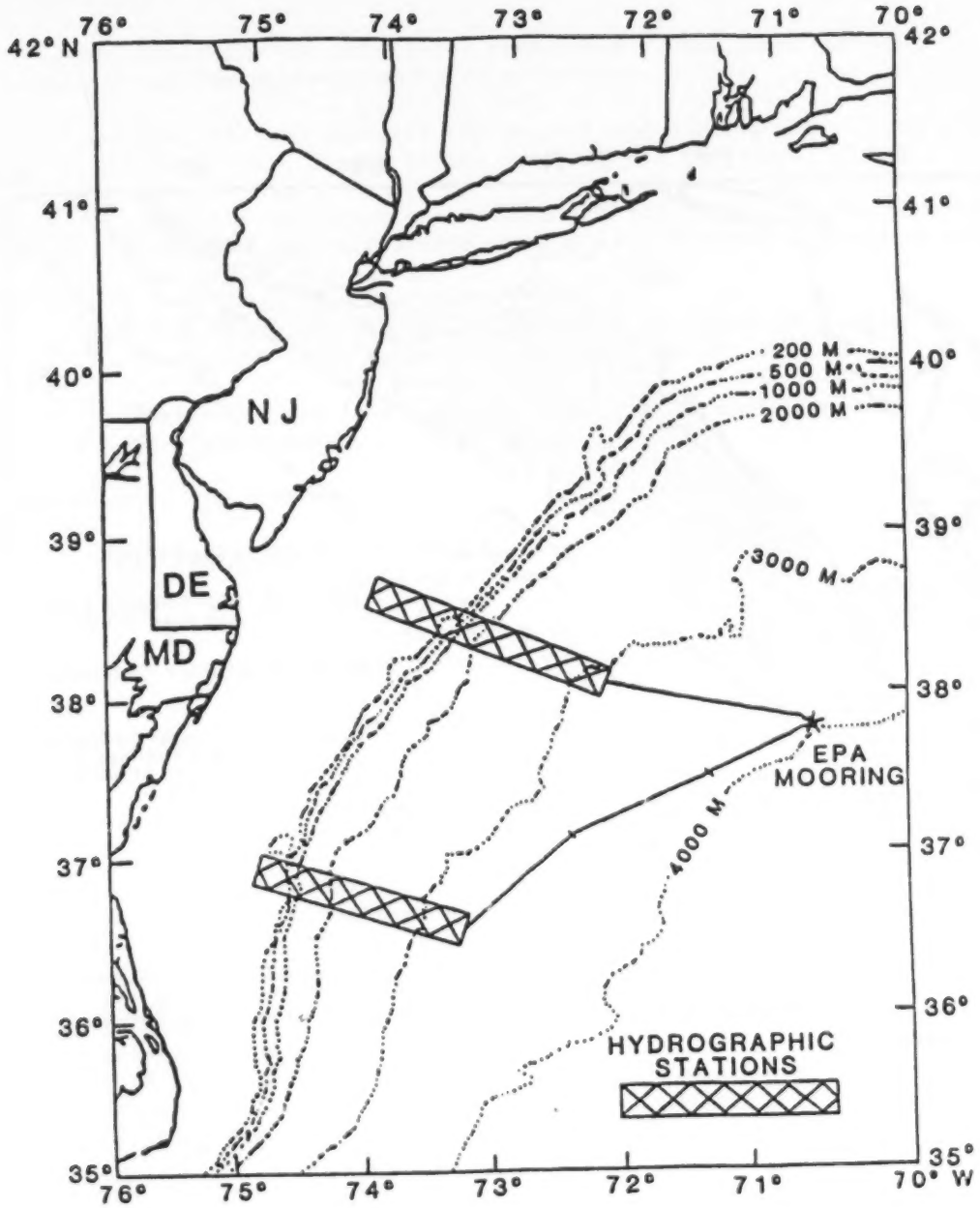

Figure 2. Actual location of Hydrographic stations occupied and the EPA mooring site during MASAR Cruise II, 27-31 May 1984.

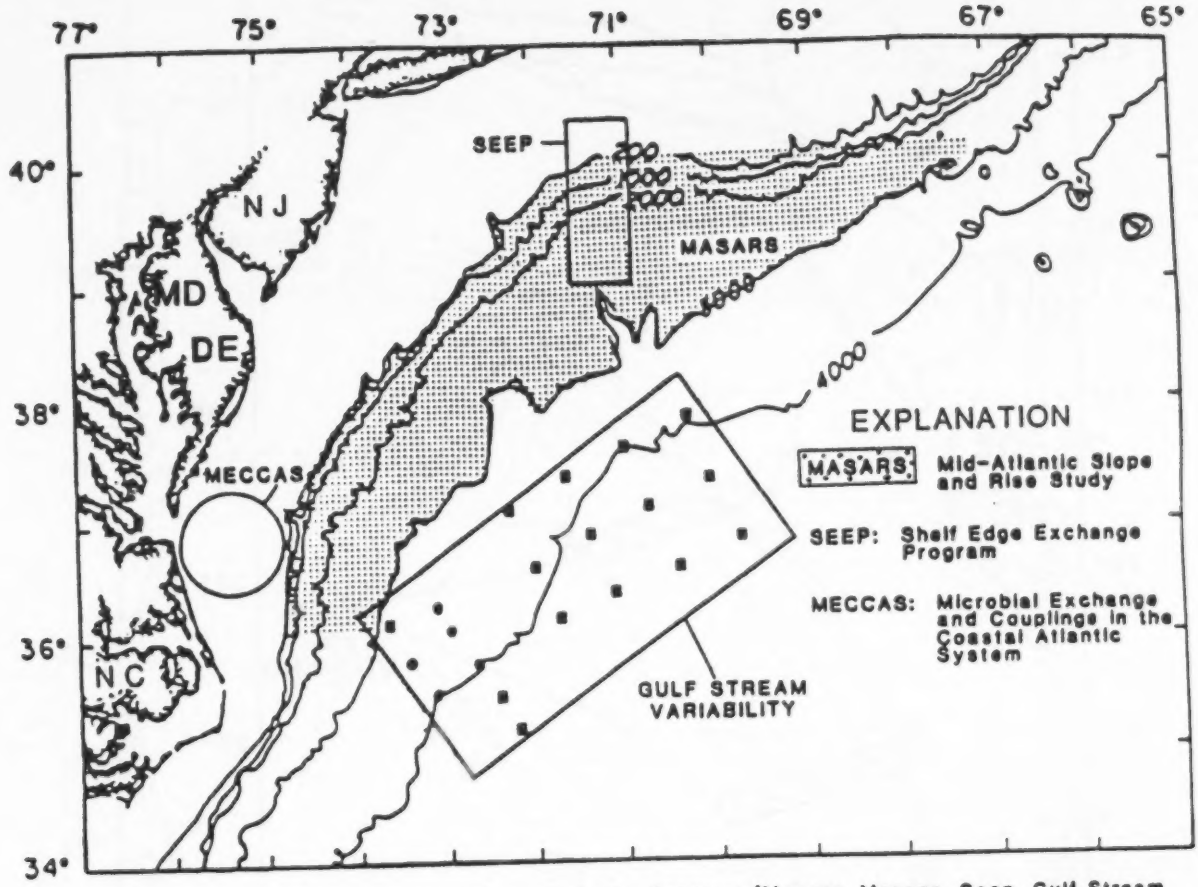

Figure 3. Mid-Atlantic Physical Oceanography Program (Masars, Meccas, Seep, Gulf Stream Variability).

° Blake Plateau Current Measurement Study (Year 3)

Objectives:

a. Determine the amplitude, speed, and direction of the Gulf Stream on time scales from hours to seasons.

b. Describe and quantify the current and temperature variability of the Gulf Stream in the vertical and horizontal planes.

c. Identify and describe the dominant physical processes producing the observed Gulf Stream variability, and determine their spatial and temporal scales.

d. Determine Gulf Stream influences on the physical oceanography of the South Atlantic Outer Continental Shelf (OCS).

e. Determine the importance of eddy-induced upwelling to primary productivity.

Measurement Type and Period:

The field program will include several data collection efforts spanning 2 and 1/2 years (February 1983 to July 1985).

a. Current measurements using several arrays of subsurface moorings placed orthogonally to the Gulf Stream axis (Figure 4).

b. Periodic satellite remote sensing during times when clear skies and good thermal structures exist.

c. Two aircraft operations to deploy dependable temperature-depths sensors (AXBT): one in June 1983, and one in April 1984.

d. One 20-day hydrography cruise in March 1984, primarily to map Gulf Stream events. This also included Ametek Straza current profiling.

The sites for the three current meter arrays, originally consisting of 17 subsurface moorings, were selected based on the expectation that the meandering and eddy motions over the three characteristic regions of the Gulf Stream would thereby be determined. Each array was placed orthogonally across the Gulf Stream axis; one across the Charleston Bump, and one off Long Bay, and one off Onslow Bay.

The positions as well as the number of moorings have changed from the original design because of the severe damage inflicted on some of the moorings. The cause is some unknown human activity and has at times forced the relocation of instruments and mooring equipment during the turnaround cruises. New moorings built to replace those lost were deployed in other than the original design positions, but within the constraints of the study requirements, in the hope that future damage could be minimized (Figure 5).

Reports and Data:

All the field data has been collected, with the exception of the current meter moorings to be retrieved in July 1985. Three semiannual progress reports as well as cruise reports are available. There are interim data products available as well. The final report is due in March 1986.

Cost:

$3,056,045

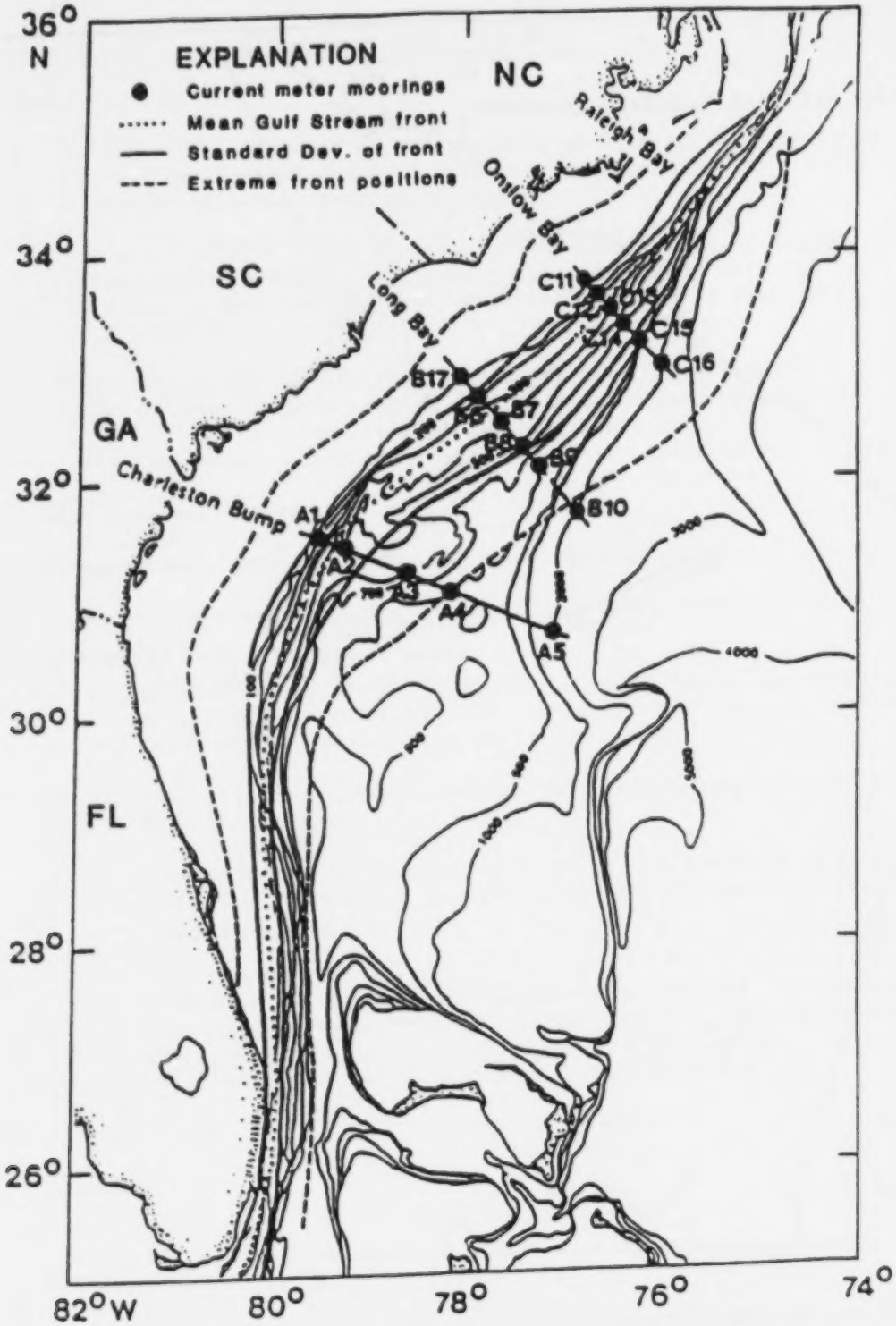

Figure 4. Location of original Blake Plateau Current Measurement Study moorings with statistics of satellite-derived Gulf Stream cyclonic front positions.

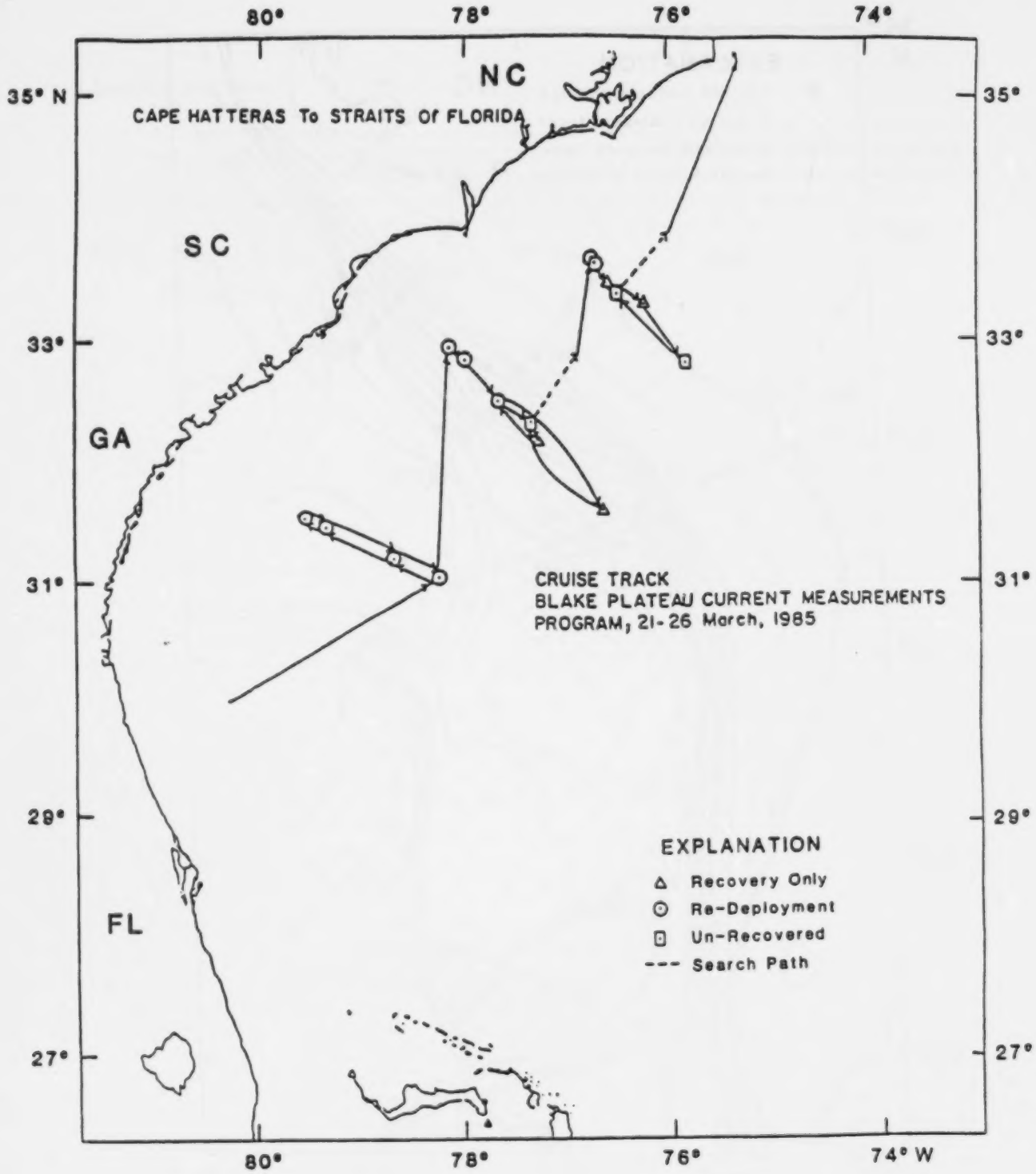

Figure 6. Relocation of Blake Plateau Current Measurment Study mooring.

° Florida Atlantic Coast Transport Study (FACTS)

Objectives:

a. Determine the frequencies and location of filament structures on the western edge of the Gulf Stream between 27°N and 31°N latitude along the Atlantic coast of Florida.

b. Produce the data on the frequencies and location of filament structures in a format that is directly compatible with the circulation model of the South Atlantic prepared by Dynalysis of Princeton.

c. Incorporate the results from this study with those of other physical oceanography studies of the Atlantic Continental Shelf of Florida in a synthesis of available information on the principal water masses and their circulation patterns in the region.

Measurement Type and Period:

Four measurement systems are being used to gather data.

a. Current meter mooring deployed from March 1984 until June 1985.

b. PEGASUS acoustic current profiling system measurements were made along a section at 29°N during April, July, and October 1984, as well as February 1985.

c. Inverted Echo Sounders and Pressure Gauges were deployed during November 1984 until May 1985.

d. Satellite tracked Lagrangian drifters. A total of 12 drifters have been released at approximately monthly intervals (Figure 6).

Reports and Data:

A final PEGASUS cruise will be made in mid-June 1985, with final current meter mooring retrieval to occur during that cruise. Two semiannual progress and cruise reports, as well as interim data products are available through March 1985. The final report is due in July 1985.

Cost:

$2,102,004

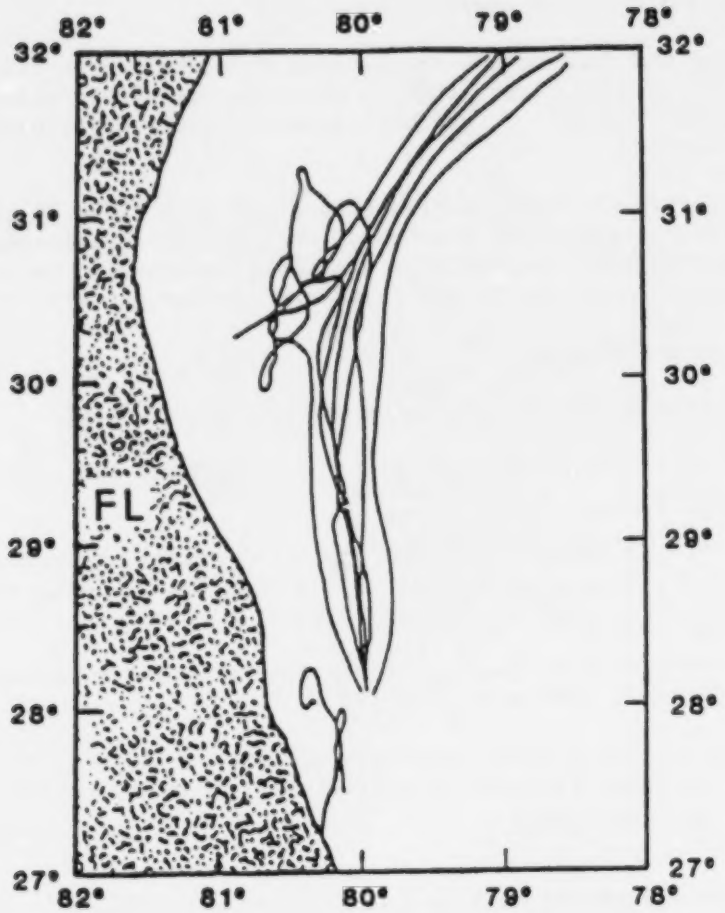

Figure 6. Lagrangian Drifter Trajectories, April–November 1984.